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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
LANDEROS, IGNACIO EMMANUEL	
ART UNIT	PAPER NUMBER
3785	

NOTIFICATION DATE	DELIVERY MODE
01/30/2012	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/594,618	HUGHES ET AL.	
	Examiner	Art Unit	
	IGNACIO E. LANDEROS	3785	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *21 December 2011*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

5)☒ Claim(s) *1-9 and 11-13* is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *1-9 and 11-13* is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☒ The drawing(s) filed on *01 August 2011* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

12)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

This action is in response to the amendment filed on 12/21/2011. Claims 1-9 and 11-13 are pending.

Drawings

1. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the superconducting windings (claim 7) must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as “amended.” If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either “Replacement Sheet” or “New Sheet” pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 1-9 and 11-13 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

4. Claims 1, 8, 11 and 12 recite the limitation "…is the exclusive thermal interface between…" in their respective last two lines. There is insufficient antecedent basis for this limitation in the claim. As best understood the recitation limits the invention to not have any mechanical thermal interface between the refrigerator and the wall shared between the closed recondensing chamber and the second recondensing chamber or cryogen vessel, rather only the cryogenic gas thermally links the two structures together (claims 1, 8, 11 and 12). Claims 2-7, 9 and 13 are rejected due to their dependency of the rejected claims (1, 8, 11 and 12).

5. The wording of claim 1, in view of the amendment, brings forth indefinite issues. The thermal interface between the cryogenic refrigerator and the cryogen vessel consists (claim 1) of much more than a gas held in contact with the refrigerator within the closed recondensing chamber. For an example, there are fins, another volume of cryogenic fluid and other heat conductive surfaces between the refrigerator and the cryogen vessel. Thus, it is not clear how the thermal interface between the cryogenic refrigerator and the cryogen vessel consists (claim 1) of a gas held in thermal contact

with a cooling surface of the refrigerator. As best understood the thermal interface, recited in claim 1, comprises of a gas held in thermal contact with a cooling surface of the refrigerator.

6. Claim 12 recites "the gas filling the first recondensing chamber is the exclusive thermal interface between the cryogenic refrigerator and the second recondensing chamber" in the last two lines. However there are walls between the cryogenic refrigerator and the second recondensing chamber. Therefore it is not clear how the gas filling the first recondensing chamber can be the only thermal interface between the refrigerator and the second recondensing chamber. As best understood, the gas filling the first recondensing chamber is the only thermal interface between the refrigerator and the wall that the first and second recondensing chambers share.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

9. Claims 1-9 and 11-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Xu et al. (US Patent No. 5,918,470), herein referred to as Xu, in view of Curtis (US Patent No. 4,802,345).

In regards to claims 1 and 3, Xu discloses a cooling apparatus **(See Figure 1)** comprising a removable cryogenic refrigerator (i.e. two-stage cryocooler 12) and a thermal interface (i.e. surfaces of cold head 30) **(Figure 1)** between the removable cryogenic refrigerator and a cryogen vessel (i.e. helium vessel 4) **(Figure 1)** by the cryogenic refrigerator (12) **(Figure 1)**, the thermal interface to comprise of a gas (i.e. gas inside of cavity 32) **(Column 4, Lines 21-26)** held in thermal contact with a cooling surface (i.e. cold head 30) of the refrigerator within a recondensing chamber (i.e. cavity 32), and the cryogen vessel (i.e. helium vessel 4) is cooled by thermal conduction through a wall (i.e. heat sink 11) of the closed recondensing chamber. Xu discloses trapped gases contained in the thermal interface gasket will escape into the recondensing chamber (i.e. cavity 32) once the refrigerator has been installed **(Column 4, Line 21-26)**. In addition, the recondensing chamber is not disclosed to be vacuum sealed when the refrigerator is installed, thus at least natural gas exists in the recondensing chamber. Further, Xu teaches the radiation shield, which is in thermal communication with the first stage cooler (16), to be cooled to 55K **(Column 2, Line 61-Column 3, Line 1)**. Therefore the recondensing chamber (i.e. cavity 32) must be in a temperature range of 55K to 4K (i.e. the second stage cooler temperature is 4K) **(Column 3, Line 27-30)**. At 55K natural gas, helium, and other gases condense into

liquids as they come in contact with heat exchanging surfaces. It is then properly concluded that a gas trapped inside of the recondensing chamber recondenses into liquid as it comes into contact with a cooling surface (i.e. cold head 30). Inherently, the liquid will fall to the bottom of the recondensing chamber due to the force of gravity, and thus will be in contact with the bottom wall (11). Xu teaches the gravitational phenomenon on liquids in column 3, lines 33-34 and again on column 3, lines 46-47. However Xu fails to disclose that gas is the only thermal interface between the cryogenic refrigerator and the wall of the closed recondensing chamber.

Curtis discloses a cryogenic refrigerator **(see fig. 1)** which comprises only a cryogenic gas (i.e. helium contained in tubular space 18) that acts as a thermal interface between the cryogenic refrigerator (i.e. cold finger 12) and the wall of the recondensing chamber (i.e. end 20, which is capable of being a recondensing surface for a potential recondensing chamber within a cryogenic cooling system). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Xu thermal interface to have no mechanical thermal link, and rather only have a cryogenic gas as the thermal interface between the cryogenic refrigerator and the wall of the recondensing chamber, as taught by Curtis, in order to more uniformly cool the wall of the recondensing chamber **(col. 2, line 1)**.

Regarding Claim 2, Xu discloses a cryogenic refrigerator (12) mounted within a sleeve (i.e. sleeve assembly 8, 18, 23) **(Figure 1)**. The sleeve (8, 18, 23) encloses the recondensing chamber (32) **(Figure 1)**. As discussed above, the recondensing chamber

(32) includes trapped gases, and thus the volume within the sleeve surrounding the refrigerator forms the closed recondensing chamber.

Regarding Claim 4, Xu discloses the bottom wall (11) of the closed recondensing chamber to be in thermal contact with a further recondensing chamber (39), which recondenses a cryogen gas (i.e. helium 5) **(Column 3, Line 27-33)** and is sealed from the closed recondensing chamber of the interface (i.e. heat sink 11 and gasket 29 seal recondenser chamber 39 from cavity 32 (cryocooler 12 is inserted into vacuum vessel 2 without destroying the vacuum) **(Column 2, Lines 46-51, see Figure 1)**.

Regarding Claim 5, Xu discloses the cooling surface (30) to be provided with fins (42) via thermal interface (29) and bottom wall (11) **(Figure 1)**.

Regarding Claim 6, Xu discloses a cryostat (i.e. two-stage cryocooler 12) **(See Figure 1)** comprising a cryogen vessel (i.e. helium pressure vessel 4) containing a liquefied cryogen (i.e. liquid helium surface level 44), a recondenser (i.e. recondenser 39) exposed to the interior of the cryogen vessel via liquid and gas helium passage 52 and 58, and the recondenser being connected to the cooling apparatus set forth in claim 1 (discussed above) **(Column 3, Line 9-20)**.

Regarding Claim 7, Xu discloses an MRI system (10) **(Column 2, Line 42)** comprising superconducting windings (i.e. superconducting magnet coil assembly 60) contained within a cryogen vessel (4) **(Figure 1)**.

Regarding Claim 8, Xu discloses a thermal interface (i.e. surfaces of cold head 30 inside of cavity 32) comprising a closed recondensing chamber (32) that is disposed around a recondensing refrigerator (12) and in thermal contact with a cryogen vessel (4) to be cooled through a wall (i.e. helium gas 40 condensed at the surface of wall 11) **(Column 3, Lines 14-32)** of the closed recondensing chamber, the closed recondensing chamber being filled with a gas which is recondensed into a liquid by the recondensing refrigerator (discussed above in claim 1) wherein thermal contact between the recondensing refrigerator and the cryogen vessel (4) is provided by recondensation of the gas via the wall (11) of the closed recondensing chamber (32) **(Figure 1)**. However Xu fails to disclose that gas is the only thermal interface between the cryogenic refrigerator and the wall of the closed recondensing chamber.

Curtis discloses a cryogenic refrigerator **(see fig. 1)** which comprises only a cryogenic gas (i.e. helium contained in tubular space 18) that acts as a thermal interface between the cryogenic refrigerator (i.e. cold finger 12) and the wall of the recondensing chamber (i.e. end 20, which is capable of being a recondensing surface for a potential recondensing chamber within a cryogenic cooling system). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Xu thermal interface to have no mechanical thermal link, and rather only

have a cryogenic gas as the thermal interface between the cryogenic refrigerator and the wall of the recondensing chamber, as taught by Curtis, in order to more uniformly cool the wall of the recondensing chamber **(col. 2, line 1)**.

Regarding Claim 9, the method limitations of claim 9 comprise the same structure as set forth in claim 1, above. A cryostat is equivalent to a cryogen vessel. The cryogenic refrigerator discussed above recondenses cryogen gas (i.e. helium) generated by the heat transfer between liquid cryogen and superconducting windings (60). The walls of the recondenser (39), including the fins (42), provide recondensing surfaces and are in thermal contact with the bottom wall (11) of a closed recondensing chamber (32) of a thermal interface (29) and are exposed to the cryogen gas via helium gas passage (52) within the cryostat (i.e. helium pressure vessel 4). The recondensing surfaces are cooled by cooling the component (i.e. superconducting windings 60) through the wall (11) of the closed recondensing chamber of the thermal interface (29) **(Column 3, Line 9-35, Figure 1)**. As discussed above in the rejection of claim 1, cavity 32 is properly interpreted to be a recondensing chamber, because it condenses gases due to its low temperature surfaces **(see cl. 1, lines 9-20, above)**.

Regarding claim 11, Xu discloses a cooling apparatus **(see Figure 1)** comprising a cryogenic refrigerator (i.e. two stage cryogenic refrigerator 12) **(Figure 1)**, a thermal interface (i.e. outer surfaces of cold head 30) **(Figure 1)** that is in thermal contact with a cooling component of the refrigerator (i.e. outer surfaces of cold head 30 are connected

to the rest of the cryogenic refrigerator 12) **(Figure 1)** and with a cryogen vessel (4) **(Figure 1)** that is to be cooled (i.e. helium gas 40) **(Figure 1)**, the thermal interface comprises a closed recondensing chamber (i.e. cavity 32) **(Figure 1)**, at least a portion of which is in thermal contact with the cooling component of the refrigerator (i.e. cavity 32 is in thermal contact with all of the cryogenic refrigerator 12) **(Figure 1)**, the closed recondensing chamber is filled with a cryogen gas (i.e. trapped gas/natural gas fills cavity 32 when the cryogenic refrigerator 12 is installed) **(Column 4, Lines 21-26)**, and is separated and sealed from a cryogen fluid contained in the cryogen vessel (4) **(Figure 1)** that is to be cooled (i.e. cavity 32 is separated from vacuum vessel 2 (vacuum sealed vessel) and helium pressure vessel 4 which contain helium gas 40 that is used to cool superconducting magnet coil assembly 60) **(Figure 1)** by a wall (i.e. heat sink 11) **(Figure 1)** that is in thermal contact with the cryogen fluid in the cryogen vessel (4) **(Figure 1)** to be cooled (i.e. heat sink 11 and fins 42 provide heat transfer surfaces for condensing helium gas 40) **(Column 3, Lines 14-33)**, the recondensing chamber is configured such that, in an operating state, gas that is liquefied in the recondensing chamber accumulates adjacent to the wall and is boiled off by heat transferred from gaseous cryogen fluid in the cryogen vessel (4) **(Figure 1)** that is to be cooled (i.e. energy can be neither created nor destroyed, thus the heat that is given off by helium gas recondensing at heat transfer surfaces 42 and 11 is transferred to the matter inside of cavity 32, which is also contains gas. The trapped gas/natural gas inside of cavity 32, adjacent to wall 11, inherently absorb heat energy from the helium gas inside of the recondensing chamber 39, therefore the trapped gas/natural gas inside of cavity 32 will

boil into a gas and recondense into a liquid so long as the helium is also recondensing into a liquid). Xu, however, fails to disclose that gas is the only thermal interface between the cryogenic refrigerator and the wall of the closed recondensing chamber.

Curtis discloses a cryogenic refrigerator **(see fig. 1)** which comprises only a cryogenic gas (i.e. helium contained in tubular space 18) that acts as a thermal interface between the cryogenic refrigerator (i.e. cold finger 12) and the wall of the recondensing chamber (i.e. end 20, which is capable of being a recondensing surface for a potential recondensing chamber within a cryogenic cooling system). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the Xu thermal interface to have no mechanical thermal link, and rather only have a cryogenic gas as the thermal interface between the cryogenic refrigerator and the wall of the recondensing chamber, as taught by Curtis, in order to more uniformly cool the wall of the recondensing chamber **(col. 2, line 1)**.

Regarding claim 12, Xu discloses a cryogenic cooling apparatus **(see Figure 1)** comprising a cryogenic refrigerator (12) **(Figure 1)**, a first recondensing chamber (i.e. cavity 32) **(Figure 1)** that is filled with a gas (i.e. trapped gas/natural gas as the cryogenic refrigerator is installed) **(Column 4, Lines 21-26)** and is in thermal contact with a cooling component of the cryogenic refrigerator (i.e. trapped gas/natural gas inside of cavity 32 is in thermal contact with the entire cryogenic refrigerator 12) **(Figure 1)**, a second recondensing chamber (i.e. recondensing chamber 38) **(Figure 1)** that is in

thermal contact with the first recondensing chamber (i.e. recondensing chamber 38 is in thermal contact with the cavity 32 via heat sink 11) **(Figure 1)** and with an cryogen vessel (4) **(Figure 1)** that is to be cooled (i.e. superconducting magnet coil assembly 60) **(Figure 1)**, the first recondensing chamber is separated from the second recondensing chamber by a common structural component (i.e. heat sink 11) **(Figure 1)** which forms a heat transfer path between the first and the second recondensing chamber (i.e. any structure between two components that have a temperature difference inherently forms a heat transfer path between the two components having a temperature difference), and which seals and isolates the first recondensing chamber from the second recondensing chamber (i.e. there is a vacuum vessel (vacuum sealed vessel) which the cryogenic refrigerator does not destroy within the cavity 32, thus cavity 32 and recondensing chamber 38 are sealed and isolated from one another) **(Column 2, Lines 46-51, Figure 1)**, the second recondensing chamber is in thermal contact with a cryogenic fluid (i.e. helium gas 40) **(Figure 1)** in the cryogen vessel (4) **(Figure 1)** that is to be cooled. Xu, however, fails to disclose that gas is the only thermal interface between the cryogenic refrigerator and the second recondensing chamber.

Curtis discloses a cryogenic refrigerator **(see fig. 1)** which comprises only a cryogenic gas (i.e. helium contained in tubular space 18) that acts as a thermal interface between the cryogenic refrigerator (i.e. cold finger 12) and the wall of the recondensing chamber (i.e. end 20, which is capable of being a recondensing surface for a potential recondensing chamber within a cryogenic cooling system). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to

modify the Xu thermal interface to have no mechanical thermal link, and rather only have a cryogenic gas as the thermal interface between the cryogenic refrigerator and the wall of the second recondensing chamber, as taught by Curtis, in order to more uniformly cool the second recondensing chamber **(col. 2, line 1)**.

Regarding claim 13, Xu discloses the second recondensing chamber (38) to be in fluid communication with the cryogen fluid (helium gas 40) **(Figure 1)** that is contained in an interior of the cryogen vessel (4) **(Figure 1)**.

Response to Arguments

10. Applicant's arguments filed on 12/21/2011 have been fully considered but they are not persuasive.

11. On pages 7-8, Applicant argues that claims 1-9 and 11-13 are allowable in view of the filed amendment. Specifically, applicant argues that Xu fails to disclose that gas is the only thermal interface between the cryogenic refrigerator and the wall of the first recondensing chamber. Examiner respectfully disagrees. Firstly, the amended claims bring forth indefiniteness issues. Secondly, the arguments are moot in view of newly found prior art Curtis (US Patent No. 4,802,345). Curtis discloses cryogenic gas that acts as the only thermal interface between a cryogenic refrigerator and a wall that defines a first recondensing chamber (tubular space 18) **(fig. 1)**.

Conclusion

12. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP

§ 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to IGNACIO E. LANDEROS whose telephone number is (571)270-1875. The examiner can normally be reached on Monday-Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Judy Swann can be reached on (571) 272-7075. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/J J Swann/
Supervisory Patent Examiner, Art Unit 3785

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